Preface

Janssen, Leon P.B.M.; Moscicki, Leszek

Published in:
Thermoplastic Starch: A Green Material for Various Industries

Publication date:
2009

Preface

A variety of users from different industries, retailers, farmers, and medical care professionals are faced with growing pressure from society and legislation to minimize non-degradable packaging waste and to switch to biodegradable materials. The driving forces powering the development of these biodegradable materials are fourfold:

- the greenhouse problem, which urgently calls for reductions in CO_2 emissions in production processes;
- the increasing amount of Solid Municipal Waste (SMW) produced in Europe and the rest of the world;
- the environmental implementations of incineration and recycling of plastics; and
- the ever increasing price and expected future shortage of mineral oil.

Despite this pressure, there is at present no biodegradable alternative for disposable plastics combining all the features, functionalities, and – especially – economics necessary for it to be really competitive. Efforts to produce competitive biodegradable packaging have been frustrated by the problem of finding the optimal balance between mechanical properties, costs, and the level of biodegradability.

An increased emphasis on sustainability, eco-efficiency, and green chemistry has driven a search for renewable and environmentally friendly resources. Starch – a biodegradable polysaccharide produced in abundance at low cost – displays thermoplastic behavior under the right circumstances, making it one of the most promising candidates as an alternative for traditional plastics in certain market segments, such as the food packaging industry. Starch is a complex homopolymer composed of α-D-glucose units linked together in two different forms: the linear form amylose and the highly branched amylopectin. The compositions and structures of starch granules vary considerably between different plants, affecting the properties and function of starches from different crops.

The EU Agricultural-Industrial Research Commission studied the potential market for bioplastics on the basis of renewable resources and predicted 1.1 million tonnes of bioplastics with an increase in economic value and job potential of €2 billion and 20 000 new jobs (European Commission. DG XII: Study on Pro-

Thermoplastic Starch. Edited by Leon P.B.M. Janssen and Leszek Moscicki

ISBN: 978-3-527-32528-3

duction of Thermo-Bioplastics and Fibers based mainly on Biological Materials, Science, Research and Development, EUR 16102). This represents a tremendous market potential for competitive biodegradable packaging material, further stimulated through EU policies. Because landfill space is running short and because incineration may create toxic emission problems, national authorities and the European Commission have defined the reduction of the traditional packaging waste stream as an area to receive priority attention. If these authorities' efforts continue, sales volumes can meet the high figures quoted above.

Numerous studies have been conducted to optimize the performance of starch-based plastics. These studies show that important properties for evaluation of a packaging material include mechanical and thermoforming properties, gas and water vapor permeability, resistance, transparency, and availability. Designing and engineering a starch-based packaging product that possesses all of these required properties, however, is a significant challenge. Product cost and technical challenges – such as brittleness associated with high loads, and poor water and gas barrier properties – have to be overcome before renewable biomaterials can be commercialized. Currently, most research directed towards enhancing the functional properties and inherent bonding strength of starch has focused on incorporating additives, such as plasticizers, to improve the material's performance.

In the framework of the EU CRAFT program of the 5th FP BIOPACK a cooperative venture was established between the Department of Chemical Engineering of the University of Groningen (NL) and the Department of Food Process Engineering of Lublin University of Life Sciences (PL). They have joined forces to develop starch-based biodegradable packaging materials with physicochemical and physicomechanical properties, handling characteristics, shape, and end-product cost that must be competitive with those of the conventional stable and non-degradable plastics. The main results of these BIOPACK investigations, as well as other important information concerning thermoplastic starch and biodegradable plastics, are discussed in this book.

Bearing the figures on market potential in mind, packaging manufacturers and users nowadays see good opportunities to improve their competitiveness and to penetrate new markets. Many profit and non-profit organizations are looking for biodegradable packaging to improve overall waste management. Possible users are big companies, small enterprises, and public organizations in the food industry, retailing, agriculture, and medical care. Biodegradable materials meet current and future legislative demands and societal awareness on waste management.

Groningen and Lublin,
August 2009

Leon P.B.M. Janssen, Leszek Moscicki